Transferring Western Knowledge to a centrally planned economy : Finland and the Scientific-Technical Cooperation with the Soviet Union

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Super power competition, the arms race, division and conflict between different socio-economic systems determine our understanding of East-West relations during the Cold War era. The US-led high technology embargo, CoCom, which controlled all technology transfers that might have had strategic importance between the West and the Soviet Union, dominated the state of affairs in the field of technology and trade. In this context, the attempt by the Soviet Union to modernize[1] seemed impossible. In spite of the hindrances created by the East-West division, the Soviet Union managed to create a system of technology transfers with Western European states that was functional, even during the coldest phases of the Cold War era. Through the system of scientific-technical cooperation (STC), the Soviet Union was able to establish official and inter-governmental connections with Western European states, which created a vivid sphere of East-West interaction in Europe.[2] In spite of the East-West divide, the Soviet Union was an attractive trade partner, which helped to cooperate through the STC with West European states during the Cold War decades.[3]

The Soviet STC with the Western European states was possible because it took place "behind the scenes" that made the Soviet STC, in spite of the ideological-political differences, functional and active from the mid-1950s until the end of the Cold War. The STC is an interesting case study because it was launched with a clear purpose to solve the problem of technology and related knowledge in the situation when technological modernization was an imperative for the So-

1 The author's research has focused on the technological modernization in the Finnish Centre of Excellence in Russian Studies "Choices of Russian Modernisation" coordinated by the Aleksanteri Institute, University of Helsinki, Finland.

2 Sari Autio-Sarasmo and Katalin Miklóssy, "The Cold War from New Perspective," in *Reassessing Cold War Europe*, ed. Sari Autio-Sarasmo and Katalin Miklóssy (Abingdon: Routledge, 2011), 1–15.

3 By the end of the 1970s, there were agreements with, among others, West Germany, France, Italy, Japan, the UK, Austria, and Finland. M. Maksimova, "Economic Relations between the Socialist and the Capitalist Countries," in *Finnish-Soviet Economic Relations*, ed. K. Möttölä, O.N. Bykov and I.S. Korolev. (London: Macmillan Press, 1983), 23.

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viet Union. The STC – and the East-West interaction based upon it – has been missing from the Cold War historiography that has focused almost solely on the macro level developments. The Soviet STC was practical cooperation on micro level and remained thus nearly invisible at the level of superpower politics. In order to make the Soviet STC visible, the focus has been placed on case studies. Neutral Finland, the first STC partner of the Soviet Union, offers a good case study to investigate the STC cooperation in practice. During the Cold War, Finland became one of the major mediators of Western technology and related knowledge with the Soviet Union. State regulation and planning,[4] which were closely connected to the system of the Finnish-Soviet trade and the Soviet-Finnish STC, supported the process of mediation. This chapter aims to analyze what kinds of processes of technology and knowledge transfers took place between Finland and the Soviet Union during the Cold War. What kinds of Western technologies were transferred, and how were the transfers disseminated into the Soviet system? The following is based on materials collected in Russian and Finnish archives, on contemporary studies, research literature, and the author's prior publications.

The Soviet technological modernization and the system of STC

The Soviet scientific-technological cooperation (STC), launched in mid-1950s was connected to the technological modernization of the Soviet economy project, which was based on the acquisition of foreign technology and related knowhow. As a leader of the new superpower, Nikita Khrushchev (1956 – 1964) followed the model adapted by Peter the Great and the strategy that had been determining factor in the modernization project by Lenin and Stalin, that is, to borrow advanced Western technology in order to move quickly forward. Khrushchev's successor Leonid Brezhnev (1964 – 1982) continued on the same path in order to maintain the Soviet superpower status amid hardening East-West competition. The technological modernization was needed to strengthen the resilience of the Soviet economy and to transform extensive economic growth into intensive one. The Soviet Union had to compete with the United States as an equal com-

4 In this chapter, planning is understood through the system of mixed economy in Finland and Finnish-Soviet clearing trade, i. e. the balanced flows of goods that were fixed to match with the Soviet five-year plans. The five-year planning horizon proved to be beneficial for the research and development (R&D) activities of the Finnish enterprises.

panion in order to prove the superiority of the socialist system and to be a credible leader for the socialist bloc.[5] Being far from autarky, the Soviet Union had to seek interaction with Western states.[6] The adopted modernization plan was based on serious planning, and on taking advantage of the existing connections with Western states in Europe with the aim to "catch up."

The key objective for the Soviet STC "to faster exploit the achievements of science and technology and the new methods of production"[7] set the goals, and illustrates well the Soviet aims in its cooperation with the West. The main actor in the Soviet STC was the State Committee of Science and Technology (GKNT),[8] which organized and coordinated all technology and know-how transfer and mediated information, propagated new practices, and took care of the diffusion of new technologies and related knowledge in the Soviet Union.[9] The STC created a system of reciprocal and bidirectional transfers of technology and related knowledge between the partners.

The Soviet technological modernization project was an extraordinary endeavor. The Soviet military-industrial complex was capable of creating the competitive high technology of which the successful space program was a good example. Technology transfers from abroad were needed because there were hardly any ties between the high-prioritized military sector and civilian industry, which

5 Sheila Fitzpatrick, *The Russian Revolution*, 2nd edition, (Oxford: Oxford University Press, 1994), 19; P. Gregory and R. Stuart, *Soviet and Post-Soviet Economic Structure and Performance*, 5th edition, (New York: Harper-Collins, 1994), 8; See also Philip Hanson, *The Rise and Fall of the Soviet Economy: An Economic History of the USSR from 1945* (London: Longman, 2003), 62; Sari Autio-Sarasmo, "Soviet Economic Modernisation and Transferring the Technologies from the West," in *Modernisation in Russia since 1900*, ed. Markku Kangaspuro and Jeremy Smith (Helsinki: Finnish Literary Society [Studia Fennica Historica], 2006), 104–123.

6 Oscar Sanchez-Sibony, *Red Globalization. The Political Economy of the Soviet Cold War from Stalin to Khrushchev* (Cambridge: Cambridge University Press, 2014).

7 M. Kaje and O. Niitamo, "Scientific and Technical Cooperation Between a Small Capitalist Country and big Socialist Country," in *Finnish-Soviet Economic Relations*, ed. K. Möttölä, O. N. Bykov and I.S. Korolev. (London: Macmillan Press, 1983), 143–144.

8 The establishment of GKNT was an outcome of a chain of reorganizations during 1957–1965. The idea of the state committee remained much the same, in spite of different names. The final name *Gosudarstvennyi komitet po nauki i tekhnologii SSSR* (GKNT) was the final result and existed between 1965–1991. Russian State Archive of the Economy (RGAE) fond 9480, opis' 2. The GKNT was part of the wider structure of collection of information in the Soviet Union together with KGB and military intelligence GRU that were in charge of the illegal transfer of technology.

9 Russian State Archive of Contemporary History (RGANI), fond 5, opis' 40, delo 52, list 1–6; RGANI fond 5, opis'. 40, delo 52, list 13–19; RGANI fond 5, opis' 40, delo 121, list 29–30.

was not able to benefit from the innovations in the military-industrial complex.[10] In order to enhance the resilience of the economy, the Soviet leadership adopted the Western post-World War Two model of economic growth. The model was based on the transformation of extensive economic growth on an intensive one with the help of developed technology, especially automation. Due to the relatively low level of technological knowhow in the socialist bloc, the Soviet Union needed foreign technology in order to keep up with extremely fast technological development.[11] Transfer of technology through the system of the STC was a solution for that problem.

In this context, the major benefit was that the Soviet STC was based on intergovernmental agreements and thus an official way to transfer Western technology and technology-related knowledge to facilitate the Soviet modernization project. Through the system of the STC, the Soviet Union was not only able to gain technology but also knowledge and expertize connected with the technology that was needed to facilitate technological development and to boost domestic innovations in the Soviet Union. In spite of the CoCom, there were ways to obtain the desired technology through illegal trade and spying.[12] These channels, however, did not further the modernization project of the Soviet Union. In order to profit from the transferred technology, it needed knowledge to use,

10 The Soviet military-industrial complex, the prioritized nine ministries, *devyatka* 'group of nine' in the 1960s and 1970s included ministry of aircraft industry, defence industry, general machine building industry, medium machine industry, radiotechnology industry, electrotechnical industry, ship building industry, machine building and communication device industry. In the 1960s, the priority was on rocket technology. N.S. Simonov, *VPK SSSR: Tempy ekonomicheskovo rosta, struktura, organizatsija proizvodstvo, upravlenie* [Military-industrial complex SSSR: Tempo of economic growth, structure, organisation of production and management]. Izdanie 2, (Universitet Dmitria Pozharskovo, Moskva 2015), 482; Irina B. Bystrova, *Sovetskij voenno-promyshlennij kompleks: problemy stanovlenija i razvitija 1930 – 1980 gody* [The Soviet military-industrial complex: problems of structuration and development 1930 – 1980] (RAN: Institut Rossijskoi Istorii Moskva, 2006).

11 Sari Autio-Sarasmo, "Khrushchev and the challenge of technological progress," in *Khrushchev in the Kremlin. Policy and Government in the Soviet Union, 1953 – 1964*, ed. Jeremy Smith and Melanie Ilic (Abingdon: Routledge, 2011),133 – 143.

12 Philip Hanson, "The Soviet Union's acquisition of Western technology after Stalin; Some thoughts on people and connections," in *Reassessing Cold War Europe*, ed. Sari Autio-Sarasmo and Katalin Miklóssy (Abingdon: Routledge, 2011), 28 – 30; For an overview, see Christopher Andrew, "Intelligence in the Cold War," in *The Cambridge History of the Cold War*, vol II, ed. Melvyn P. Leffler and Odd Arne Westad (Cambridge: Cambridge University Press, 2010), 430; In this chapter, illegal transfers are not investigated.

diffuse and refine it.[13] The STC enabled the transfer of the technology-related knowledge but it was also a way to establish bilateral cooperation that helped to maintain and continue the knowledge transfers and the technology trade in the future.

For the Soviet Union, neutral Finland was an easy choice as the first partner for the STC. Finland was part of the Russian Empire as an autonomous grand duchy from 1809. In 1917 Finland became independent and the two states continued the long tradition of bilateral trade until the "Winter War" broke out in 1939.[14] After the peace treaty in 1945, the Soviet Union demanded Finnish war reparations to focus on a certain type of technologies, which forced Finland to develop a machine-building industry. This served the Soviet plan well of turning Finnish production more in the direction of technology that was desired and needed in the Soviet Union.[15] The war reparations and the signing of the treaty of friendship, cooperation and mutual assistance (FCMA) between Finland and the Soviet Union in 1948 directed postwar relations and created the basis for the Finnish-Soviet trade.

Finland became the first market economy country to sign a five-year agreement on the exchange of goods with the Soviet Union; this was for the years 1951–1955.[16] In 1955, three years after the completion of war reparations, the FCMA treaty was prolonged and the agreement of the Soviet-Finnish STC was concluded.[17] The Soviet-Finnish STC agreement was the first treaty between

13 Philip Hanson, *Trade and Technology in Soviet-Western Relations* (London: Macmillan, 1981), 223; Gary Bertsch, "Technology Transfers and Technology Controls: a Synthesis of the Western-Soviet Relationship," in *Technical Progress and Soviet Economic Development*, ed. Ronald Amann and Julian Cooper (Oxford: Oxford University Press, 1986), 127–128; Ian Jackson, *The Economic Cold War. America, Britain and East–West Trade, 1948–1963* (London: Palgrave, 2001).

14 The Soviet Union attacked Finland on 30 November 1939 and the short war was called the "Winter War." After a short period of peace, the conflict started again in 1941 and lasted until 1944. The "Continuation War" was part of World War Two. After the peace in 1945 large areas of Eastern Finland were annexed to the Soviet Union and Finland had to pay heavy war reparations to the Soviet Union.

15 Tatiana Androsova, "Economic interest in Soviet post-war policy in Finland," in *Reassessing Cold War Europe*, ed. Sari Autio-Sarasmo and Katalin Miklóssy (Abingdon: Routledge, 2011), 33; Markku Kuisma, *Kylmä sota, kuuma öljy. Neste, Suomi ja kaksi Eurooppaa* [Cold War, hot oil. Enterprise Neste, Finland and the divided Europe] (Helsinki: Werner Söderström Ltd, 1997).

16 Juhani Laurila, *Finnish-Soviet Clearing Trade and Payment System: History and Lessons* (Helsinki: Bank of Finland Studies A: 94, 1995), 30.

17 "Sopimus tieteellis-teknillisestä yhteistoiminnasta Suomen tasavallan ja SNTL:n välillä, 16.8.1955" [Agreement on scientific-technical cooperation between the Republic of Finland and the Soviet Union], http://www.finlex.fi/fi/sopimukset/sopsteksti/1955/19550030 (accessed 15 September 2017).

any two states with different economic systems to agree upon scientific-technical cooperation (STC) on a contemporary basis.[18] Since the main targets for the Soviet STC were the technologically more developed countries in Western Europe, in the 1950s cooperation with Finland served as a model to establish connections with the West and rehearse East-West interaction in practice.[19] In spite of the fact that during the early years of cooperation Finland served as a testing site for the Soviet cooperation with the West, the STC agreement set the direction of the Finnish-Soviet technology cooperation for years to come.

State regulation and planning: Finnish-Soviet trade and the STC

The STC was strongly intertwined into the Soviet-Finnish trade. The trade was based on state regulation and planning through the mixed economy system of Finland. The Finnish-Soviet trade was based on the bilateral clearing system, that is, the balanced flows of goods was fixed to match the Soviet administrative and central management and planning system but in a way that did not hamper the workings of the Finnish market economy. The clearing arrangements consisted of five-year agreements and annual trade protocols. Each agreement determined the volume and content of trade for the forthcoming five-year period. These agreements focused on the exchange of goods and set concrete targets for trade by containing lists of imports and exports and specifying the value and volume of delivered goods. The lists were prepared in cooperation with the Finnish firms and Soviet foreign trade organizations. The prices of individual deliveries were negotiated and contracted between a supplier and a purchaser. The positive side of the system was that trade was foreseeable due to the long

18 A. Romanov, "Suomen ja Neuvostoliiton välisen tieteellis-teknisen yhteistyön tuloksia," in *Suomen ja Neuvostoliiton välinen tieteellis-tekninen yhteistoiminta 30 vuotta* [The results of the Finnish Soviet scientific-technical cooperation in Soviet-Finnish STC 30 years] (Helsinki, 1985), 8.

19 The main target in the West in the 1960s for the Soviet Union was technologically developed West Germany. RGAE fond 9480, opis' 7, delo 805, list 9; RGAE fond 9480, opis' 7, delo 805, list 39 – 41; The Soviet-West German trade agreement was concluded in 1958 and cooperation was widened after the agreement of cultural and scientific-technical cooperation in 1959. Archive of the Russian Academy of Sciences (ARAN) fond 579, opis' 13, delo 147, list 1 – 15; About the case of West Germany, see Sari Autio-Sarasmo, "Knowledge through the Iron Curtain: Soviet Scientific-Technical Cooperation with Finland and West Germany" in *Reassessing Cold War Europe*, ed. Sari Autio-Sarasmo and Katalin Miklóssy (Abingdon: Routledge 2011), 66 – 82.

agreements with secure payments. The drawback of the arrangement was that trade became very bureaucratic.[20]

The development of Finnish-Soviet trade presents a good picture of the structure of the Finnish-Soviet trade (import/export) in the 1970s and the simultaneous intensification of the STC.[21] Finnish exports to the Soviet Union took a remarkable leap in the mid-1970s. This was due to the worldwide oil crisis in the early 1970s that prompted almost inexhaustible Soviet demand for Finnish goods: the higher the oil price, the greater the export possibilities for Finland.[22] The value of Finland's exports to the Soviet Union almost doubled from 1974 to 1975.[23] The share of exports from Finland to the Soviet Union was 13.8 % in 1971–1975 but in 1976 the exports were 20.2 % in one year. Due to the clearing trade, import from the Soviet Union increased correspondingly: in 1971–1975 import was 14.7 % but in 1976 the share was 18.5 %. In 1978, the Soviet Union was the biggest trade partner of Finland and Finland was the third biggest trade partner of the Soviet Union.[24] Finnish-Soviet trade was at its highest in the first part of the 1980s. In 1982–1983, the share was over 25 %, which was the peak year of the trade. For a short period of time, Finland was the most important trading partner for the Soviet Union.[25] Finnish-Soviet bilateral trade is a good example of "the commerce between countries with different economic and social systems" and thus Finnish-Soviet trade resonates well with the aims of the TRADESOC section in UNCTAD analyzed by Michel Christian in this volume. If not the most traditional one, there were several elements in the trade that were advocated in the Finnish-Soviet trade. At the same time, however, the Finnish-Soviet trade

20 Laurila, *Finnish-Soviet Clearing Trade and Payment System*, 18–21, 60–62, 100–103.

21 Pekka Sutela, *Trading with the Soviet Union. The Finnish Experience 1944–1991* (Helsinki: Kikimora Publications Series B 39, 2014), 42.

22 Sutela, *Trading with the Soviet Union*, 44–45. This also worked the other way round: when the oil price was low, Finland benefitted in terms of income, but had to accommodate decline in exports to the Soviet Union.

23 "Value of Finnish imports and exports by country 1856–1975" (Table 5.14.) in *Suomen taloushistoria. Historiallinen tilasto,* osa 3 [Economic History of Finland. Historical Statistics, part 3], ed. Kaarina Vattula (Helsinki: kustannusosaekyhtiö Tammi, 1983), 240; One explanation for the increase of exports was the oil crisis during which upward oil prices increased Finnish exports to the Soviet Union due to the bilateral balancing of Finnish-Soviet trade. Sutela, *Trading with the Soviet Union*, 64.

24 *Suomi-SNTL: Tieteellis-teknisen ja taloudellisen yhteistyön vuorovaikutus. Raportti Suomen ja Neuvostoiiton välisen yhteistyön metodologiaa koskevasta tutkimuksesta*. Osat 1–2 [Finland-SSSR: Scientific-technical and economic interaction. Report on the methodological study of the Soviet-Finnish cooperation. Part 1–2] (Helsinki: Suomen ja Neuvostoliiton välisen tieteellis-teknisen yhteistoimintakomitean julkaisusarja 7, 1980), 15–16.

25 Sutela, *Trading with the Soviet Union*, 49, 64. On a per capita basis.

is a good example of the Soviet Union willingness to focus solely on bilateral trade.[26]

It is possible to see the interconnectedness of the Finnish-Soviet trade and the STC in the development of trade and the organization of the STC. The permanent Soviet-Finnish commission on economic cooperation based on the model of the STC was established in 1967 to support the development of the trade. Two years later the scientific cooperation was strengthened by establishing discipline-based working groups under the structure of the STC. In 1971, the treaty to develop economic, technological, and industrial collaboration between Finland and the Soviet Union was signed. In 1974 and 1975, long-term programs to increase economic and industrial collaboration between the two states were approved. In 1977 a long-term program was signed to deepen and develop the economy and trade in the field of industrial and scientific-technical cooperation between Finland and the Soviet Union until 1990. From the 1970s, the main aim of the joint programs was to increase technology transfers and especially technology trade between the two states.[27]

The Finnish mixed economy system enabled planning and state regulation that maintained the strong connection between the trade and STC. Many of the large conglomerates participating in the Finnish-Soviet trade and the STC were owned by the state, which made the regulation and planning even easier. In addition, actors in the trade and the STC were the same: intergovernmental working groups, trade delegations, Finnish enterprises, and the Soviet foreign trade organizations.[28] The five-year agreements and secured payments made the Finnish-Soviet trade attractive for Finnish enterprises. The trade possibilities in the Soviet Union and the whole socialist bloc offered huge possibilities for Finnish partners. Through the system of bilateral trade, Finnish enterprises were able to export upgraded goods to the Soviet Union and in exchange Finland was able to import oil and energy.[29] At the state level over-dependence on Soviet trade and Soviet oil was seen as problematic. That is why Finland tried to trade with the West and diminish its energy dependence on the Soviet Union by cooperating with Western oil suppliers. Still, the share of the trade was high and the

26 Michel Christian, "It is not a question of rigidly planning trade" in this volume.

27 *Suomi-SNTL: Tieteellis-teknisen ja taloudellisen yhteistyön vuorovaikutus. Part I*, 16–17.

28 Riitta Hjerppe, "Teollisuus" in *Suomen taloushistoria. Teollistuva Suomi*. Osa 2 [Economic history of Finland. Industrializing Finland, Part 2], ed. Jorma Ahvenainen, Erkki Pihkala, Viljo Rasila (Helsinki: Kustannusosakeyhtiö Tammi 1982), 412–413; Laurila, *Finnish-Soviet Clearing Trade and Payment System*, 61.

29 *Suomen ulkomaankauppatilasto 1971* [Export statistics of Finland 1971] (Helsinki 1972), 82–83.

share of the Soviet oil was at least half of Finnish oil imports.[30] Due to the fact that the clearing trade was based on a balanced flows of goods, it was difficult for Finland to find marketable goods to import from the Soviet Union. During the years of Finnish-Soviet trade, the imbalance of export/import was the major problem, but as a whole the trade with the Soviet Union was beneficial for Finland. The disadvantage of the clearing trade with the Soviet Union was that it cast a shadow on Finland's desired image in the West as a free, modern and developed Western market economy.[31]

Soviet STC and Finland – focusing on practical cooperation

The commission of Soviet-Finnish scientific-technical cooperation was established in 1955 as a state-level organization comprising of the Finnish ministry of foreign affairs, the Academy of Finland, and in the Soviet Union, the State committee of science and technology (GKNT) and the Soviet Academy of Sciences. The early years of the cooperation mainly consisted of reciprocal visits to the basic industrial production units that were possible to organize without overly complicated official arrangements. Soviet experts visited Finnish production units where the experts in *komandirovka* 'assignment' wrote reports about their observations, which were very practical, such as details related to the equipment used, lighting, and the organization of work.[32] This information was collected in order to develop the organization of work at home and was based on interaction with the experts; Soviet experts asked questions and hosts shared information with their guests. During the late 1960s, when the technological development in Finland was fast, the STC started to divide into two: scientific cooperation and technological cooperation. The scientific cooperation consisted of experts from Finnish and Soviet universities, research institutes and ministries (in the Soviet Union). Finnish and Soviet experts met and exchanged information during the reciprocal visits, seminars, workshops, and conferences organized on the basis of the STC. In the bilateral meetings current scientific issues were discussed

30 Kuisma, *Kylmä sota, kuuma öljy,* 257, 275.

31 Laurila, *Finnish-Soviet Clearing Trade and Payment System,* 100 – 103.

32 A Soviet delegation visited the city of Tampere in August 1958 in local factories. Noted in the report was, for example, the quality of machinery (mainly American and West German). Russian State Archive of Scientific-Technical Documentation, branch in Samara (RGANTD) f. 18, op. 2 – 6, d. 205, l.1 – 12; Similar examples in West Germany, see RGANI, f. 5, op.40, d. 67, l. 1 – 2.

(such as new trends and technologies). Scientists conducted joint research projects and wrote books together.[33]

The technological cooperation consisted of the experts but also of Finnish enterprises and the Soviet trade organizations. In the export-oriented Finnish firms, it was understood that participation in the STC helped to widen economic and industrial cooperation with the Soviet Union.[34] In the field of technology cooperation, the system was closely connected to the Finnish-Soviet trade.[35] Technological knowhow had diversified in Finland because of the active collaboration with the Western enterprises, of which the electronic industry and oil refining industry were good examples.[36] These areas were also the primary interest of the Soviet partners. When Finland's connection and access to the Western technology and knowhow increased, the Soviet partners' interest in collaboration with the Finnish enterprises increased too. From the late 1960s, the visits of the Soviet partners were much better prepared than before. To enhance the process, the GKNT organized the collection of in-advance information, which increased Soviet specialists' ability to adapt knowledge during their visits. Soviet technology advisors in the Soviet embassies in respective countries collected the information available in technology fairs, such as brochures and advertisements, but also through specialized literature that was used to plan and specify the target enterprises to visit.[37]

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33 A good example is the Finnish-Soviet STC in the field of computer science. ARAN f. 579, op. 13, d. 162, l. 72–73; Concerning the Soviet delegations visits, see: ARAN f. 579, op. 13, d. 162, l. 17–34. From Finnish side, see Selostus suomalais-neuvostoliittolaisesta symposiumista 13.5.1975 [Report from Soviet-Finnish symposium 13.5.1975)]. Commission of the Finnish-Soviet scientific-technical cooperation: travelogues. Archive of foreign ministry of Finland (FMA).

34 *Suomi-SNTL: Tieteellis-teknisen ja taloudellisen yhteistyön vuorovaikutus, Part I*, 11.

35 In the case of Finland, see for example, Tieteellis-teknistä yhteistoimintaa varten Suomen tasavallan ja Sosialististen Neuvostotasavaltain liiton välille asetetun suomalais-neuvostoliittolaisen komitean pöytäkirja 17.-25.2.1956 Moskovassa pidetystä istunnosta (jäljennös) [Copy of the protocol of establishment of the commission on scientific-technical cooperation between Finland and the Soviet Union]. Commission of the Finnish-Soviet scientific-technical cooperation (STC), Archive of Finnish foreign ministry (FMA).

36 Martti Häikiö, *Fuusio. Yhdistymisen kautta suomalaiseksi monialayritykseksi 1865–1982* [History of the enterprise Nokia 1865–1982, part 1] (Helsinki: Edita, 2001), 99; Kuisma, *Kylmä sota, kuuma öljy*, 255.

37 RGANI fond 5, opis' 61, delo 55a, list 45–55. Soviet *sovetniki*, 'technology advisors' worked as coordinators between the GKNT and foreign enterprises; Instruction of the use of foreign journals: RGAE fond 9480, opis' 7, delo 805, list 81–86. Collected information was administered and translated into Russian by the All-Union Institute of Scientific-Technical Information, (*Vsesoyuznyi institut nauchnoi i tekhnicheskoi informatsii*, VINITI). RGANI fond 5, opis' 33, delo 46, list 15–16, 21. VINITI was established in 1952. It collected and produced summaries from 22,000 sci-

The Soviet specialists were assigned clear plans of action for their visits. On the basis of the information collected in advance, the GKNT drew up a list of questions about technological processes to be answered during the visit, based on detailed knowledge of the production of the receiving enterprise.[38] After demand for the new technology increased remarkably in the Soviet Union in the 1960s and 1970s, the cooperation started to focus on technology related-knowledge. It is possible to observe this phenomenon in the archival materials for instance when the Finnish partners brought to the discussions problems with the Soviet experts who were eager to get information about technology that was forbidden by strict license and patent agreements.[39] The cooperation became challenging for Finnish partners who did not want to risk problems in their contacts with their Western partners.

By focusing on the practical cooperation, the Soviet Union was able to keep the STC cooperation bilateral and use it in a way that served the needs of the Soviet side without creating tensions in the superpower politics. A good example of the target-oriented STC activity in the field of high technology was the establishment of the working group in cybernetics, later a working group on computer technology. During Khrushchev's leadership, cybernetics was given an important

entific journals and publication series, and about 8,000 books from 130 countries in 70 different languages. It was re-organized under the jurisdiction of the GKNT and the Academy of Sciences. Seppänen, Jouko, *Tieteellis-tekninen informaatio Neuvostoliitossa* [Scientific-technical information in the Soviet Union] (Helsinki: Suomen ja Neuvostoliiton tieteellis-teknisen yhteistoimintakomitean julkaisusarja 2, 1978).

38 RGAE fond 9480, opis' 7, delo 805, list 57.

39 Neste Oy:n vastaus TT-komission tiedusteluun 16.10.1961 [Reply from enterprise Neste to the enquiry sent by the commission of scientific-technical cooperation]. 13/647–55, FMA. The letter referred to the earlier experiences; In West Germany, the Soviet experts were accused of industrial espionage and Soviet experts' visits to the West German enterprises were suspended. RGAE fond 9480, opis' 7, delo 805, list 138. Illegal trade and spying were organized in more effective ways e. g., through military intelligence (GRU) and KGB. Additionally, dummy firms were established in Europe to acquire desired technology. *Report. Soviet acquisition of Western technology* (Library of Congress, 1. April 1982); Collection of information during the Cold War was easily connected to technological espionage. In the STC spying was not – at least not openly– an expressed aim because the desired information was available freely; Kuisma, *Kylmä sota, kuuma öljy,* 276. Finnish oil refining enterprise Neste collaborated with American technology enterprises; Although Finland was not a member of the CoCom embargo, enterprises were unwilling to share knowhow that was in conflict with the CoCom lists; Niklas Jensen-Eriksen, "CoCom and Neutrality: Western Export Control policies, Finland and the Cold War, 1949–58," in *Reassessing Cold War Europe*, ed. Sari Autio-Sarasmo and Katalin Miklóssy (Abingdon: Routledge, 2011), 49–65.

role in technological modernization.[40] The position of cybernetics changed in the mid-1960s when Leonid Brezhnev took over the leadership. In spite of the previous existence of Institutes of Cybernetics and efforts to develop Soviet computer technology, the Soviet leadership made a decision to give up the development of its own computer systems and to copy IBM 360[41] technology in 1969. Coinciding with the decision, the Soviet STC partner suggested the establishment of the working group of cybernetics through the system of STC to Finnish counterparts. The timing was impeccable because through the Finnish cooperation, Soviet experts gained access to the software that was needed to make the copied computers work.[42] Computer technology remained one of the major interests in the STC until the end of the Cold War.

The Cold War context created frameworks for the Soviet technology cooperation with the Western partners. Furthermore, it explains the ways in which the cooperation was motivated and organized. The Soviet-Finnish STC was based on individual projects, which helped to keep the cooperation bilateral and motivated on both sides. The Soviet partners were willing to strengthen the state-level cooperation and trade that would have supplied the economic, technological, and scientific demand in the Soviet Union. As a capitalist country, Finland was motivated by economic profit, marketing possibilities, and possibility to enhance domestic R&D. For the Finnish STC partners, especially export-oriented enterprises, the main motivator was direct contact with the Soviet partners.

40 A good example of this was the establishment of the Tallinn Institute of Cybernetics, which was part of Tallinn University of technology. Sampsa Kaataja, "Expert Groups Closing the Divide: Estonian-Finnish Computing Cooperation Since the 1960s," in *Beyond the Divide. Entangled Histories of Cold War Europe*, ed. Simo Mikkonen and Pia Koivunen (Oxford: Berghahn books 2015), 103. According to Kaataja, Tallinn Institute of Cybernetics did not participate in fully classified projects but was a category B institution. There is an increasing number of studies focusing on Soviet cybernetics, see for example Slava Gerovitch, *From Cyberspeak to Newspeak. A History of Soviet Cybernetics* (Cambridge, MA: MIT Press, 2002); An important contribution to the field of cybernetics but also technology transfers is Egle Rindzeviciute, *The Power of Systems. How Policy Sciences Opened up to the Cold War World* (Ithaca and London: Cornell University Press, 2016).

41 About IBM in Finland, see Petri Paju and Thomas Haigh, "IBM rebuilds Europe. The curious case of the transnational typewriter," *Enterprise & Society* 2(2015); Petri Paju, "Monikansallinen yritys ja siteet länteen. IBM Suomessa ja Länsi-Euroopassa 1940-luvun lopulla ja 1950-luvulla" [A multinational corporation and ties to the West: IBM in Finland and in Western Europe during the post-war years and the 1950s], *Historiallinen aikakauskirja* 3 (2015).

42 Autio-Sarasmo, "Knowledge through the Iron Curtain," 72; For a discussion about the benefits of the cooperation, see ARAN, fond 579, opis' 13, delo 162, list 72–73. Other contributions in this volume thematize the East-West dimension of the computerization process – i. e. Sandrine Kott, "The social engineering project" and Ondřej Matějka, "Social engineering and alienation between East and West."

When they had direct contacts, firms were able to collaborate outside the official STC organs.[43] The Finnish enterprises were able to negotiate directly with their Soviet partners and agree, for example, on the prices.[44] The "technological turn" in the STC and the Soviet-Finnish trade took place in the 1970s when the technological level had markedly increased in Finland.

Finland as a mediator of Western technology to the Soviet Union

The Finnish enterprises in Soviet trade were mainly large conglomerates. The five largest accounted for almost 40 % of all exports from Finland to the Soviet Union because of the clearing trade system. Due to the long-term contracts, the privately owned profit-maximizing enterprises actively participated in the trade.[45] Finnish exporters were able to use the Soviet markets' springboard to the Western markets because Finland was able to develop and produce exports for which there was no demand in Finland. Long-term contracts and trade agreements and secured payments increased security in Finland and Finnish exporters were protected from external competition.[46] In the 1970s, when it was difficult to get into the Western market, the Soviet Union offered several trading possibilities and strict payments. Among especially successful enterprises were conglomerates that could offer a large assortment of products to supply Soviet demand.

A good example of an enterprise like this was Nokia, a conglomerate that became a member of the Soviet-Finnish STC in 1957. Nokia's cooperation and trade with the Soviet Union illustrates the development of the STC from the 1950s until 1991. During the Cold War era, Nokia had two major export lines to the Soviet Union: cables and communication devices.[47] Although Nokia became well known for communication devices, especially mobile phones in the

43 These organs were the STC Commission and Economic Commission in Finland and in the Soviet Union Ministry of foreign trade, State Committee of Foreign Trade (GKES), ministries, and commercial missions of the Soviet Union in Finland. *Suomi-SNTL: Tieteellis-teknisen ja taloudellisen yhteistyön vuorovaikutus. Part I*, 40 – 43.

44 Laurila, *Finnish-Soviet Clearing Trade and Payment System*, 60 – 62.

45 Sutela, *Trading with the Soviet Union*, 65 – 66.

46 Laurila, *Finnish-Soviet Clearing Trade and Payment System*, 100 – 103.

47 Martti Häikiö, *Sturm und Drang. Suurkaupoilla eurooppalaiseksi elektroniikkayritykseksi 1983 – 1991. Nokia Oyj:n historia.* osa 2 [History of enterprise Nokia 1983 – 1991, part 2] (Edita: Helsinki, 2001), 195.

1990s, it was cable production that created the cornerstone for Nokia's beneficial trade with the Soviet Union. Soviet industry was not able to produce enough cables to meet the increasing demand, which opened large and widening trade possibilities for Nokia with the Soviet Union. Nokia had to follow the export quota defined in the state-level trade protocols for the exchange of goods, but being a privately-owned, profit-maximizing enterprise, Nokia's main aim was to make the export quotas as high as possible in order to gain maximum benefit from the trade with the Soviet Union.

In 1971 a protocol of exchange of goods was signed. It included the export of high technology cables. This profitable deal was important for enhancing the R&D and furthering other units at the Nokia conglomerate. The mid-1970s represented an especially beneficial time after the oil crisis when the Soviet Union wanted to import more cables than Nokia was able to produce. As a conglomerate, Nokia could exploit the positive turnover in the other units. One of the reasons for the possibility to develop R&D in Finland was the system of bilateral trade, which included the pre-pay system. When the product was partly paid in advance, it gave Finnish partners the advantage of developing their products, especially technology which was not only for the Soviet trade but targeted at Western markets as well. Thus, the Soviet trade was a useful stepping stone for new and expanding firms such as Nokia, but it also secured markets for other Finnish enterprises.[48]

Nokia Electronics started in the 1960s and developed on the basis of the Soviet trade. For Nokia – as well as other Finnish enterprises – connections to technologically-advanced Western countries were extremely important. The Finnish firms sent personnel to work in the electronic firms in the United States in order to learn to use the newest technologies in this sphere. Nokia bought electronic devices from West Germany (Siemens) and delivered the provided technology to Finland. The share of electronics in Nokia's exports was 40 %, of which 30 % was directed to the Soviet Union and COMECON countries and 10 % to the West. In the 1970s, computer technology and computer systems became part of Nokia's portfolio and Finnish banks ordered computers and computer systems from Nokia.[49] Simultaneously the interest of the Soviet partners started to focus on these systems and STC visits focused on enterprises using these technologies.[50] These visits were partly connected to the work of the STC working

48 Sutela, *Trading with the Soviet Union*, 67, 73.

49 Häikiö, *Fuusio*, 93, 156, 161,164.

50 ARAN fond 579 opis' 13, delo 162, list. 17–34; Neuvostoliittolaisen delegaation Suomen vierailu. TT-komitea: saapuneet kirjeet [Soviet delegation in Finland, letters]. 1/1–30/6–71 FMA; Se-

group of cybernetics. The cooperation bore fruit decades later when Nokia delivered digital phone exchanges to the whole Soviet communication system.[51] The Soviet Union clearly played a crucial role in the development of Nokia Electronics.

Personal contacts and mutual trust were essential in the cooperation with the Soviet Union. These factors were especially important in the technology trade. That is why the role the commission of STC was fundamental when building contacts between Finnish enterprises and Soviet partners. In the 1980s when the Nokia's trade with the Soviet Union was at its highest, Nokia's CEO was a member of the Soviet-Finnish Commission on STC. Because of the bureaucratic and slow Soviet system, personal contacts were demanded at every level to enhance the collaboration. Trust was earned through the long partnership and good reputation but in Nokia's case the physical presence of its representatives in the Soviet Union proved to be very beneficial for trade. Nokia opened an office in Moscow in order to organize exhibitions and to facilitate negotiations with Soviet partners.[52] When the Cold War cooled down, personal contacts became even more important. Individual approaches and personal connections were used whenever it was needed to bypass the official and politically embedded macro (state) level politics.

After the Soviet invasion of Afghanistan in 1979, the CoCom restrictions were tightened remarkably. Although not a member of the CoCom embargo, Finland followed the strict trade restrictions.[53] Nokia had to adjust to Finland's economic policy and to take into account the changing situation. Finnish electronic industry needed American components and thus could not ignore the US geopolitics. Especially in the late 1970s and 1980s, the Finnish STC with the Soviet Union was viewed by the United States as suspicious and problematic.[54] The concern and suspicion in the United States was certainly partly justified, because besides the trade with the Soviet Union Nokia also delivered technology to the Finnish army. This became alarming in the 1980s when the CoCom embargo was signifi-

lostus suomalais-neuvostoliittilaisesta symposiumista 13.5.1975. TT-komitea: matkakertomuksia [Report from the Finnish-Soviet symposium. ST commission, travelogues] 1956–1978. FMA.

51 Häikiö, *Sturm und Drang*, 54–55.

52 Sutela, *Trading with the Soviet Union*, 2014, 88; Häikiö, *Sturm und Drang*, 47–48, 50, 53; Häikiö, *Fuusio*, 120, 157–158, 182. Nokia's CEO Kari Kairamo was an important figure in Finnish trade in the 1980s.

53 Jensen-Eriksen, "CoCom and Neutrality," 58–61.

54 *Report: Soviet Acquisition of Western Technology* April 1 1982 (Library of Congress). The report did not mention Nokia or Finland but similar activities were defined as "suspicious."

cantly tightened.[55] In order to get American components, Nokia had to get approval from the United States to continue trade with the Soviet Union. The solution was that Nokia's CEO made a personal agreement with the Pentagon to provide them with information about technological progress in the Soviet Union.[56] The fact that Finnish enterprises were always technologically one step ahead of the Soviet Union, kept the cooperation on track. In the late 1980s, Finland concluded a secret, state-level agreement with the United States about how to continue trade in the both directions.[57] By this time, however, Soviet-Finnish trade was reaching its final stage.

It is possible to argue that Nokia was able to continue trade with the Soviet Union under surveillance because the technology traded to the Soviet Union did not threaten the military strategic equilibrium. Nevertheless, the other branch of advanced technology in Finland, the ship building industry and especially the construction of icebreakers, was followed more closely during the Cold War.[58] A good example of the Cold War restrictions directly influencing Finland is connected to the case of Finnish mini-submarines in the 1980s. The Soviet Academy of Sciences ordered two deep-sea mini-submarines able to dive down to six kilometres from the Finnish conglomerate Rauma-Repola. At the beginning, the project was not objected to by Finland's Western allies, because they believed that Finland was not able to master the advanced technology needed for the project. Still the project was closely followed by the United States. After finishing the order successfully, the United States started to pressure the shipyard Rauma-Repola Oceanics by threatening the mother company Rauma-Repola with bank-

55 Full technological information was delivered only after the next generation device was created. Häikiö, *Sturm und Drang*, 126 – 127.

56 Interviews with Former Deputy Minister of Defence Richard Perle in the documentary film "Kauppasotaa pinnan alla" [Trade war under water]. Presented by Channel One YLE on Finnish Television 7 December 2008. Assistant Secretary of Defence in the Bush Administration in the US, Richard Perle was in charge of the negotiations with Nokia. The existence of the agreement was confirmed by Stefan Widomski, former Senior Vice President International Trade Affairs in Nokia corp. Discussion with Widomski in Helsinki in 21 May 2014.

57 Autio-Sarasmo, "Knowledge through the Iron Curtain," 74. Clearing trade between Finland and the Soviet Union/Russia ended in 1991.

58 For the political dimension and techno-politics of the Soviet-Finnish icebreaker trade, see Saara Matala, "Flashy flagships of Cold War cooperation – The Finnish-Soviet nuclear icebreaker project," *Technology & Culture*, 4/2018 forthcoming. Saara Matala, "The Business of Foreign Affairs. Unrealized visions of joint business, technology and politics in Finnish -Soviet shipbuilding at the end of the Cold War". (Paper presented in the ICOHTEC International Committee for the History of Technology) in *Proceedings of the 41th ICOHTEC Symposium 2014 Technology in times of transition*, ed. Helerea, E., Cionca, M, Ivãnoiu, M (Brasov: Transylvania University of Brasov, 2014), 65 – 70.

ruptcy. In the end, two ready-made vessels were delivered to the Soviet Union but Rauma-Repola was forced to abandon Oceanics and the whole branch of the deep-sea industry.[59]

Transferred technology in the centrally planned economy

The main aim of the Soviet economic modernization project was the dissemination of the transferred technology and related knowledge into the Soviet R&D and industry to boost domestic innovations and thus facilitate the modernization of the Soviet (civilian) industry. Dissemination of the transferred technology and knowledge was essential for the process of diffusion,[60] the next phase of the modernization process that would have created a strong basis for the use of new applications and the emergence of domestic innovations. This process was expected to change the technological basis of the Soviet economy and to transform its extensive economic growth into an intensive one. From the perspective of Soviet leaders, the intensification would have increased the resilience of the USSR economy, and domestic innovations would have enabled the independent development of the Soviet industry and so lead to modernization.[61]

In the 1960s and 1970s, the main organ in the dissemination of the transferred technology and knowledge was the State Committee of Science and Technology (GKNT). It was in charge of new technologies and methods of developing science and technology in the Soviet Union. Thus the GKNT also coordinated the transfers channelled through the STC.[62] The process of dissemination and implementation of the transferred technologies had been evaluated in the mid-1950s. Due to its poor outcomes, the whole system was reorganized in the late 1950s in order to improve the process. One of the major changes was that GKNT's role in

59 Sutela, *Trading with the Soviet Union*, 93.

60 Diffusion is the process by which new technology and related knowledge is transferred through certain channels among the members of social system. Everett M. Rogers, *Diffusion of Innovations*, Third Edition (New York: The Free Press of Glencoe, 1983). Rogers refers also to the transfer of knowledge and technology.

61 Intensification, growth and innovation have been the main concepts in the Soviet and Russian modernization discussion. For an overview of the modernization discussion, see Joachim Zweynert and Ivan Boldyrev, "Conflicting patterns of thought in the Russian debate on modernisation and innovation 2008–2013," *Europe-Asia Studies* 69, No. 6 (2017), 921–939.

62 *Suomi-SNTL: Tieteellis-teknisen ja taloudellisen yhteistyön vuorovaikutus. Part II*, 37, 163; Rogers, *Diffusion of Innovations*, 335.

the dissemination of the collected information to the Soviet R&D and industry were clarified and strengthened. In order to make the process more effective, the GKNT was given authority to sign international contracts with foreign enterprises and organizations.[63] In addition, the GKNT was subordinated more clearly to the centralized planning system.

The Soviet planning system was seen as a booster for the dissemination process by determining how much and where the resources (including transfers) were to be allocated and how the allocations were controlled.[64] In spite of the obvious advantages of the planning system in resource allocation and mission-oriented projects, the main problem was that the innovation emphases and plan fulfilment were almost always in conflict. A major innovation often required several years before it began to operate successfully. The planning horizon in the Soviet Union was short and did not enable experimentation that would last several years. Any new technology also required considerable new resources and new suppliers, which represented a fundamental problem because of the lack of horizontal connections[65] between industries in the USSR. All branches of civilian industry needed to compete for the same materials, which resulted in departmental barriers being set up. The prices of new products were often set at a level that provided a lower rate of profit and counted for less towards plan fulfilment than the older, standard products. Hence, if plan fulfilment was threatened, the tendency was to shift away from new products toward the safe, old ones. There was a great gap between Soviet scientific and engineering achievements and the capacity to transform them into economically

63 *Suomi-SNTL: Tieteellis-teknisen ja taloudellisen yhteistyön vuorovaikutus. Part II*, 165; A good example of this kind of contract was the one signed with West German enterprise Siemens in 1971. RGAE fond 9480, opis' 9, delo 2509 A, list 18 – 26 L; See also RGAE fond 9480, opis' 7, delo 816, list 57.

64 Joseph Berliner, *Soviet industry from Stalin to Gorbachev. Essays on management and innovations* (Aldershot: Edward Elgar, 1988), 225; E.P. Hoffman & R.F. Laird, *"The scientific-technological revolution" and Soviet foreign policy* (Oxford: Pergamon Press, 1982), 82. Scientific research work was connected to the planning system in the 'thirties and 'forties. Loren Graham, *Science in Russia and the Soviet Union. A short History* (Cambridge: Cambridge University Press, 1993), 181; See also Alec Nove, *An Economic History of the USSR, 1917 – 1991* (London: Penguin books, 1992), 350.

65 In the cases where horizontal connections were created, the outcome of the process was also more successful. A good example is the case of the Kirov *kolkhoze* in Estonia. Antti Sarasmo, "The Kirov Fishing *kolkhoz*. A Socialist Success Story" in *Competition in Socialist society*, ed. Katalin Miklóssy and Melanie Ilic (Abingdon: Routledge, 2014), 53 – 70.

competitive innovations.[66] Paradoxically, it was the same centralized control that enabled impressive mission-oriented projects, such as the Soviet space program, yet blocked innovation in many other fields.[67]

It was paradoxical that the process of transfer was very functional and included tools that could have enhanced the dissemination and diffusion of new technologies. One of the tools was the system of organizing expert visits through the STC. These visits were not only channels for communication between Finnish and Soviet experts, but also a way to obtain the knowledge necessary for the successful diffusion process. During their visits, based on their own expertize, specialists collected different kinds of knowledge about the technology, but also about how to use it. After their visits, they wrote reports based on their observations and returned the questionnaires they were expected to fill during their visits to the GKNT. The GKNT was expected to deliver the information to the Soviet R&D and industry in order to develop further transfers and diffusion of the technologies and related knowledge. Practical information that was collected and reported by the specialists in their travel reports would have been easy to adopt in everyday work. However, the adaptation at the shop-floor level proved to be poor. The futility of the personal contributions to the process and the inability of individuals to utilize the imported models in their own work created an atmosphere of deep discontent among Soviet specialists. This brought the aspect of unintended consequence to the transfer process.[68]

There are various explanations for the problems in dissemination, implementation, and diffusion of the transferred technology and related knowledge. The dissemination might have taken place but the diffusion was not realized and in many cases the transferred technology was implemented into use as such. This was especially the case when there was an urgent demand for certain technology. It was easier to start production by directly using the technology rather than to launch time-consuming experiments based on the new technology in order to enhance domestic innovations. Furthermore, there were departmental barriers created by the system of a planned economy but also institutional and personal barriers that hindered the process of diffusion and also implementation.

Such barriers were visible for instance in the Soviet forest industry that was one of the many modernization projects in the Soviet Union carried out during

66 Hoffman & Laird, *The Scientific-Technological Revolution*, 98; Berliner, *Soviet industry from Stalin to Gorbachev* 203, 218.

67 Graham, *Science in Russia and the Soviet Union*, 201.

68 Sari Autio-Sarasmo, "Technological Modernisation in the Soviet Union and Post-Soviet Russia: Practices and Continuities," *Europe-Asia Studies* 68, no.1 (2016): 79–96.

the Khrushchev leadership in the 1950s and 1960s. In the forest industry transferred technology filled technological gaps and helped the branch to be more competitive. At the same time there were clear failures in implementing transferred technologies and supporting innovations either based on the transferred technologies or genuine domestic innovations.[69]

The case of continuous pulp cooking[70] provides a good example in which different techniques had been innovated in the West but also in the Soviet Union. This genuine Soviet innovation did not succeed and the Western technology was implemented in the Soviet pulp mills. The Soviet pulp mills are a good example of the role of Finland as a mediator of the new technology. A major part of the most advanced pulp mills in the Soviet Union were originally Finnish but became Soviet when the Karelian Isthmus was annexed to the Soviet Union after World War Two. The original Finnish technology was used in the mills until the demand for more modern technology emerged. In the beginning, the Soviet innovation was introduced to the pulp cooking but due to severe problems in implementation, the home technology was replaced by foreign technology. Finland, again, had an important role in the mediation of the new technology and related knowledge. The Soviet forest industry specialists visited Finland through the STC and collected information. The existing knowledge and the implementation of the new technology did not solve the problem of the low quality pulp. The main reasons for the poor outcome were the quality of the raw material, problems in maintaining technology, the lack of spare parts, and horizontal connections and problems in sharing information. The system did not support providing enough resources for complicated technology.[71]

Similar problems emerged in other complicated systems of technology. In the 1980s, Nokia participated in the Finnish-Soviet protocol of an exchange of goods channelled through the STC with the project of the automatic phone exchange system DX 200. The DX 200 project was Nokia's production collaboration with the Soviet partner, that is, cooperation on an enterprise-production unit level. In the project, there was a conflict between the expectations and practical cooperation from the Soviet side. The Soviet partners seemed to be interested in

69 Elena Kochetkova, "The Soviet Forestry Industry in the 1950s and 1960s: A Project of Modernization and Technology Transfer from Finland," *Publications of the Faculty of Social Sciences* 52 (2017).

70 The pulp cooking is an interesting case because it had a dual meaning. Pulp was also needed in the military industry (especially in the production of ammunition) that explains the resource allocations to the field.

71 Elena Kochetkova, "A history of failed innovation: continuous cooking and the Soviet pulp industry, 1940s-1960s," *History and Technology* 31, no. 2 (2015), 108–132.

the long-term collaboration in order to "learn-by-doing." But even though the system was based solely on planning in Nokia (Finland) and all the components came from the West (from the US, Japan or Germany) the Soviet partners were not able to benefit from the collaboration as expected. The Soviet partners complained that Nokia had not sent the necessary information to them and thus they had not been able to "sovietize" the production, that is, to produce equipment and components in the Soviet Union. Nokia replied to the accusations saying that all technical information was shared with the Soviet partners well in advance. The reply brought to the fore the fact that the problem was at the technological level of the Soviet partners and not in the actions of Nokia. In spite of the occasional problems, Nokia continued its projects of production collaboration with the Soviet Union. Among others, Nokia exported communication systems, robotics, and computer technology to the USSR.[72]

Conclusion

The Soviet system of the scientific-technical cooperation created an active network of bilateral connections between the Soviet Union and the Western European states. The Soviet-Finnish STC is a good example of how "behind the scene" East-West cooperation developed during the decades of Cold War division. When the Soviet-Finnish STC began in the mid-1950s the contacts were relatively modest and consisted mainly of reciprocal visits and the transfer of basic information. During the 1970s and 1980s, the cooperation started to focus on high technology and joint projects between Finnish and Soviet partners. The Soviet-Finnish STC was specific because it was connected and supported by the Finnish-Soviet clearing trade, regulated by the state and based on planning. For Finland, the role as mediator of Western technology and its cooperation with the Soviet Union proved to be beneficial. The Finnish export-oriented enterprises learned quickly to cooperate with the Soviet Union and to adjust their supply to the demand of the Soviet partners. With long trade agreements and secured payments from the Soviet trade, Finnish enterprises were able to focus on R&D and develop their products for the Western markets as well. Finland learned to "play" the Cold War and to balance trade with Soviet Union according to its own goals to increase Western trade. Thanks to this capacity Finland was able to diversify its economy and to transform into a technologically-oriented, modern state during the Cold War decades.

72 Häikiö, *Sturm und Drang*, 56–57, 196–198, 254.

On the other side, from the point of view of modernization, economic diversification or domestic innovations, the outcome did not meet the aims of the Soviet Union. The main aim of the Soviet STC and its trade with Finland, i.e. the transfer of technology and related knowledge to boost domestic innovations and to enhance economic modernization, was not fully realized. The practical transfers through the bilateral STC proved to be very effective. Technologies and related knowledge were transferred to the Soviet Union through the STC according to the plan created by the GKNT. However, the dissemination, implementation and especially the diffusion of transferred knowledge to the Soviet R&D and industry proved to be difficult. Transfers, including new production models, technology and related knowledge, were processed in the system of GKNT, but the dissemination to the production level was not realized as planned. Technologies were not adapted at the shop-floor level as expected and the Soviet R&D was not able to boost domestic innovations. The system of the Soviet planned economy favored the fulfilment of the plan and the lack of horizontal connections created barriers that hindered the introduction of new technologies and technological experiments.

Technology transfers during the Cold War substantially influenced the innovation policy in the Soviet Union with obvious consequences for contemporary Russia. The Soviet Union acquired new technology from abroad and paid for the transfers with raw materials and energy. This created a basis for the one-sided, raw material-based economy that has proved to be one of the major obstacles for economic development in contemporary Russia. Current discussions about the economic modernization of Russia follow the same discursive patterns today as they did in the 1970s. The road towards the diversification of the economy presupposes competitive domestic innovations and intensive economic growth that would enhance resilience in the economy which in the Soviet-Russian case has remained an elusive objective.